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Airport Movement Area Safety System (AMASS) Intersecting Runways Parameter Study Test Plan

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January 2001

DOT/FAA/CT-TN01/04

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN01/04		

4. Title and Subtitle	5. Report Date
Airport Movement Area Safety System (AMASS) Intersecting Runways Parameter Study Test Plan	January 2001
	6. Performing Organization Code: ACT-310
7. Author(s): Dan Dellmyer	8. Performing Organization Report No.: DOT/FAA/CT-TN01/04
9. Performing Organization Name and Address: U.S. Department of Transportation, Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City International Airport, NJ 08405	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City International Airport, NJ 08405	13. Type of Report and Period Covered: Technical Note
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The purpose of this Airport Movement Area Safety System (AMASS) Intersecting Runways Parameter Study Test Plan is to describe the approach and concept that will be used to determine a recommended set of alert parameters for intersecting runways alerts. The plan describes the data collection and analysis that will be used to determine which intersecting runway parameter set will maximize the AMASS safety benefit while minimizing the number of nuisance alerts generated.

17. Key Words	18. Distribution Statement
Airport Movement Area Safety System (AMASS) Terminal Automation Interface Unit (TAIU)	Document is on file at the William J. Hughes Technical Center Library, Atlantic City International Airport, NJ 08405

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	8	

Form DOT F 1700.7 (8-72)

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EXECUTIVE SUMMARY

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1. INTRODUCTION.

1.1 PURPOSE.

The purpose of this Airport Movement Area Safety System (AMASS) Intersecting Runways Parameter Study Test Plan is to describe the approach and concept that will be used to determine a recommended set of alert parameters for intersecting runways alerts. The plan describes the data collection and analysis that will be used to determine which intersecting runway parameter set will maximize the AMASS safety benefit while minimizing the number of nuisance alerts generated.

1.2 SCOPE.

The scope of the parameter study will be limited to the collection and analysis of target of opportunity AMASS log data and simulated target injection against that data. The AMASS data will be collected from San Francisco International Airport (SFO), Lambert-St. Louis International Airport (STL), and Chicago-O'Hara International Airport (ORD). Based on the parameter study results, a determination will be made whether a National Alert parameter set can be recommended for the intersecting runway alerts or if specific alert parameter sets will be recommended based upon each airport specific crossing runway configuration.

2. REFERENCE DOCUMENTS.

The following documents are referred to in this test plan or provide useful information:

a. AMASS Specification, dated November 1995

b. AMASS Operational Requirements Document, dated April 1995

c. AMASS Functional Requirements Document

d. AMASS Software User's Manual, dated September 2000

3. AMASS SYSTEM DESCRIPTION.

3.1 AMASS MISSION.

The AMASS is a runway collision alert system that provides tower air traffic controllers with both aural and visual alerts of potential runway collisions.

3.2 AMASS SYSTEM DESCRIPTION.

The AMASS system receives digitized video from the Airport Surface Detection Equipment-3 (ASDE-3) and airborne approach targets from the Terminal Automation Interface Unit (TAIU). The TAIU receives beacon target data from the Surveillance Communications Interface Processor (SCIP) and aircraft tag data from the Automated Radar Tracking System (ARTS). The TAIU tracks this data and sends appropriate position, vector, and a predicted approach runway to AMASS. The AMASS centroids and tracks the ASDE-3 digitized video and performs false track processing. AMASS and TAIU tracks are then processed by the AMASS Safety Logic to determine if any targets have the potential to create a collision. When it is determined there is a possible collision situation, AMASS will deliver an aural alert, a visual text message, and highlight the targets in potential conflict on the ASDE-3 display.

The AMASS system relies on the ASDE-3/TAIU configuration, local airport operations, and external equipment interfaces. All the AMASS alerts were tested in the factory, but only a sub-set was optimized for the various sites. Listed below are the settings for the current national alert set scenarios:

National Alert Set	Time/Distance
a. Arrival to an Occupied Runway	20 to 30 seconds/6000 feet
b. Arrival to a Closed Runway	TAIU Threshold (6000 feet)
c. Departure on an Occupied Runway	40 seconds/15000 feet
d. Lander to an Occupied Runway	20 to 30 seconds/6000 feet

4. TEST APPROACH AND CONCEPT.

The intersecting runway alerts provide safety for aircraft on active intersecting runways. A suitable alert parameter set will maximize the additional safety benefit by providing an alert with as much lead-time as possible while minimizing the number of nuisance alerts generated that do not require additional actions to prevent a collision. The concept of this parameter study is to characterize various alert parameter sets by the alert lead-time they provide and by their nuisance alert rate.

The approach of this parameter study is to first determine a practicable alert parameter set, which has a reasonable alert lead time for each airport in the study. This will be done by generating specific scenarios for each alert type and collecting timing information on the resultant alerts. Each scenario will be run multiple times with various alert parameters until an initial set of practicable alert parameters for that alert type has been determined.

Then, for each airport in the study, target of opportunity data will be reprocessed against that initial alert parameter set to characterize that parameters set's nuisance alert rate. Each nuisance alert will then be reprocessed using various alert parameter sets to characterize the nuisance alert and develop an alert parameter set that removes it. This will result in a group of alert parameter sets with characterized nuisance alert rates. Each of these alert parameter sets will then be reprocessed using the specific scenarios used to determine the initial alert parameter set. This will than characterize each parameter set's alert response time. This will result in a group of alert parameter set with known lead times and nuisance alert rates.

4.1 ALERT SCENARIOS.

The testing will require creating scenarios for each intersecting runway alert situation listed in table 4.1-1. The scenarios will be used to evaluate each intersecting runway alert for operational use and parameter settings. The scenarios will be composed of injected targets and AMASS log data. These scenarios will be used to help determine practicable values for the time/distance parameters and the intersection K-factors.

Time (Forward Projection Time) is the maximum track separation in seconds before AMASS determines that the Incursion State between the tracks is a problem.

Distance (Separation Distance) is the minimum track separation in feet before AMASS system determines that the Incursion State between the tracks is a problem.

K-Factor: The K-factor is a parameter used to extend the intersection based on the velocity of the track approaching it. The result of this calculation is used to determine if the track will be in the intersection in the future, and at the same time that another track may be in the intersection.

TABLE 4.1-1. INTERSECTING RUNWAYS ALERT SITUATION

	Alert Situation
1	Departure vs Departure
2	Departure vs Departure Abort
3	Departure vs Lander
4	Departure vs Taxi
5	Departure vs Arrival
6	Departure vs Stop Target
7	Arrival vs Departure Abort
8	Arrival vs Taxi
9	Arrival vs Lander
10	Arrival vs Arrival
11	Arrival vs Stop Target
12	Lander vs Departure Abort
13	Lander vs Taxi
14	Lander vs Lander
15	Lander vs Stop Target

4.2 DATA COLLECTION.

The AMASS log files will be collected at the following AMASS sites. These sites were selected based on the number of runway intersection operations.

a. San Francisco International Airport
b. Lambert-St. Louis International Airport
c. Chicago-O'Hara International Airport

Approximately 60 days of data will be collected at each site. (Five months of archived data has been collected at SFO and will be used in the test effort.)

4.3 DATA ANALYSIS.

After the log file data has been collected, the files will be sent to ACT-310 at the Technical Center for initial data reduction and analysis using the AMASS PC Platform. AMASS includes a playback feature that allows for the rapid replay of log files. Therefore, log files will be reprocessed using the playback feature with record while play enabled. The record while play function creates an RWP file (binary format only), which contains only Alert Summary data. The AMASS log utility program (hu_lga.exe) will be used to generate Alert Summary reports which contain the total number of alerts, and type of each alert.

Once this initial set of Alert Summary reports have been generated, each alert will be entered into the Alert Log report. The intersecting runway alerts will be evaluated and classified as

nuisance alert or real alert (the alert provided collision avoidance). Each nuisance alert will then be reprocessed using various alert parameter sets to characterize the nuisance alert and develop an alert parameter set that removes it.

4.4 TEST AND ANALYSIS TOOLS.

The data analysis effort requires the use of the ACT-310 AMASS PC Platform Test Bed. This test bed uses simulated and/or recorded AMASS log data to playback and/or reprocess data for analysis and testing purposes.

No other special test and analysis tools will be needed to complete the test effort.

5. TEST MANAGEMENT.

The AMASS Integrated Product Team (IPT) plans, directs, and implements all System test activities. The IPT coordinates inputs on schedules and resources from other pertinent Product team members for use in overall planning.

The following IPT organizations are key contributors to the test effort:

a. AND-410, the AMASS Program Office, provides the coordination with the field offices necessary to perform the test effort.

b. The AMASS Working Group (AWG) is a composite team of Air Traffic and National Air Traffic Controllers Association (NATCA) personnel who have been chartered to be the focal point for AMASS issues. The AWG will receive the intersecting runway Alert Parameter Study recommendation and make any final determinations as to operational implementation.

c. ACT-310, Surveillance Branch, will provide test leadership and technical expertise to the IPT in planning and conducting Operational Test and other test activities. ACT-310 has been given the primary responsibility for the direction of test planning, test conduct, and test reporting activities associated with the AMASS program.

5.1 TEST CONDUCT TEAMS.

The test conduct teams shall consist of a Test Lead, and two Test Engineers. The Test Lead will be responsible for verifying that the pretest conditions have been met, reviewing the test report and deciding when the test has been completed. The Test Engineers will be performing the data collection, reprocessing the log files, analysis, and filling out the alert log.

The Test Lead shall work with the Test Engineers to assist and guide them through the collection and analysis process.

5.2 TEST REPORTS.

A Test Report will be provided to the AMASS Program Manager and the AMASS AWG within 2 weeks following the completion of the test effort. The Test Report will document the results of the test effort and highlight the technical performance of the alerts.

6. ACRONYMS.

AMASS	Airport Area Movement Safety System
ARTS	Automated Radar Tracking System
ASDE-3	Airport Surface Detection Equipment-3
AT	Air Traffic
AWG	AMASS Working Group
IPT	Integrated Product Team
NATCA	National Air Traffic Controllers Association
ORD	Chicago-O'Hara International Airport
PC	Personal Computer
SCIP	Surveillance Communications Interface Processor
SFO	San Francisco International Airport
STL	Lambert-St. Louis International Airport
TAIU	Terminal Automation Interface Unit